MS. FARROBA: But is it inside the remote terminal?

MR. LUBE: Again, it's going to be a site-specific thing. It almost -- well, extremely seldomly would it ever been in a cabinet, just because we all know how tight a lot of cabinet space usually is. If you're talking about a CEV or a hut it very possibly could be located right inside the CEV or the hut.

The size of an ECS -- and let me make a very specific point here -- again, like I said very early on, we do not think it's prudent to pre-equip an entire RT line capacity with a big, giant cross-connect field inside of an RT whether it's a hut or a CV and certainly not a cabinet.

So the ECS -- when an ECS is requested by a CLEK and we construct it on their behalf it is sized based on what their need for pairs are, literally how many pairs to each of the FDIs that are served out of that RT.

So I just want to make sure that you understood that it wasn't, you know, an entire 100 percent capability device that we're deploying with an ECS.

MR. ORREL: This is Barry Orrel with Quest. I'd like to just add to on to what we were saying earlier. We talked about the fact that it would be more costly to place cross-connect fields in a controlled environment, if you will, and I just want to expand on that a little bit.

If you -- the reason that the cross-connect fields today are separate from the remote terminals is because remote terminals contain electronics that require power, HVAC, etcetera. Those kinds of things cost more than a non-hardened box such as an FDI. Cross-connects don't require power, they don't require HVAC. It's much cheaper to have that box separate from the remote terminal, which is how our networks got deployed to be the way they are.

To now require, say some time in the future, that cross-connect fields be contained within the remote terminal, the remote terminals are going to have to grow. In addition, with the existing terminals that are there if there is space to do -- to place those cross-connect fields you're also going to have to account for the fact that the investment that was made there is accommodating a certain amount of heat dissipation and a certain amount of power usage. Those kinds of investments will be lost.

MS. ROSENWORCEL: I think we're going to move on now to quality of service issues. The second question we have listed is what determines the feasibility of offering various ATM classes of service such as constant bit rate, variable bit rate or available bit rate over the shared transmission facility?

Any volunteer?

MR. RANSOM: Well, I'll comment in the context of

light span. We provide the constant bit rate and the UBR non-constant bit rate services right now at our site.

Typically, what controls the economics and so forth is in general one tries to minimize the complexity of equipment that's provided remotely. So rather than try to make the remote terminal as though it is some sort of an ATM switch with every variety of ATM service that you can imagine, it's far more economic to try to do the minimal functions required at a remote site, and then put other equipment that's housed in the central office that can do other kinds of services.

So in general we've found that the minimal will be some sort of variable rate bursty kind of service and then some kind of fixed rate services. We've looked at whether it's necessary to expand that set to other kinds, but we've found that those two pretty much handle the application and for now that seemed to be the optimal choice in our particular equipment.

MR. STANSHINE: Excuse me. CBR and UBR then are your standard options?

MR. RANSOM: Yes. In light span those are the two options available.

MR. STANSHINE: Does there -- is there an additional charge if somebody wants CBR and UBR versus UBR only?

MR. RANSOM: Well, now we're an equipment manufacturer.

MR. STANSHINE: That's right.

MR. RANSOM: Oh, do you mean if you order a light span with one capability or the other?

MR. STANSHINE: Yes.

MR. RANSOM: No. Those are not optional elements. They come with the release of the ATM equipment.

MR. STANSHINE: It's a stripped down model, basically.

MR. RANSOM: Yes.

MR. STANSHINE: Thank you.

MR. SACKMAN: The other thing I'd like to mention is that at least CBR and UBR are models that have been rolled out in very large-scale networks, It's not clear that if you're going to deliver 220 million end points or however many there are in the United States that you can roll out any kind of intermediate style VBR service effectively and PSTNs all CBR and the Internet is all UBR and the rest of it's sort of in the middle.

We're talking about an ATM-type system that was never organized to deliver $29.95 a month or $49.95 a month service with variable bit rate across a large number of interfaces.

So even though it's technically possible, whether

it's economical or logistically possible with actual human beings that are available for the carriers to deploy today is a completely separate question.

MR. STANSHINE: Okay. But AFC now is offering UBR and CBR --

MR. SACKMAN: We also offer VBR.

MR. STANSHINE: Okay. The ability to offer that again is as common -- does the stripped down model offer both UBR and CBR? Does CBR cost more?

MR. SACKMAN: No. The product that has to do all those features and offer them inherently and we don't charge extra for that, the question is, is whether it's operationally --

MR. STANSHINE: Okay. But it's all in the common equipment, the ability to do a --

MR. SACKMAN: No. It's distributed throughout the entire piece of equipment on every line card, on every piece of equipment we make.

MR. STANSHINE: Okay. Thank you.

MR. LUBE: From the ILEC perspective, I agree with the comments from the manufacturers about, you know, what sorts of capabilities they build into their products and, of course, we as the purchaser of those equipment products are reliant upon what capabilities are in those products to begin with. I mean that's just as a preliminary matter.

But there are some -- and there are costs associated with that, as I think -- as I think my colleague referred to, ultimately getting down to the most critical issue of how many dollars per month you can sell this stuff for?

Which, by the way, everything we deploy or everything we consider for deployment, that's a very key issue to us because the broad band market, as I'm sure you all know, is a very price-competitive market.

So deployment decisions that we make in the network organization are absolutely directly keyed to these costs that we're talking about. So speaking of those costs there's more to the picture than just the costs that are built into the equipment that we buy from the DLC vendors.

Depending on how the network is actually architected by the ILEC -- like, for instance, in the project pronto network we have the NGDLC remote terminal in the field but we have the scaled-down ATM switch that we call the optical concentration device, the OCD, in the central office. There's interconnections between those two.

When you start talking about other ATM quality of service classes you immediately start talking about band width. A network as it is deployed, physically deployed, does not have infinite, unlimited band width. I mean we know that technology does marvelous things with capacities

and stuff, but as a network is deployed it has -- especially with respect to electronics in the network, it has limited band width.

If you start talking about the provisioning to thousands and thousands of subscribers of other quality of service classes you have to look at the band width that you've got available and what is the price tag to augment that band width?

In our instance, if we're trying to modify our platform, the project pronto platform, to accommodate more band width, then that involves the addition of central office OCD equipment, either the addition of other transport capacity, whether it's additional fibers or electronics on those fibers.

So there are network design issues that are above and beyond the manufacturing design issues that are a key element here.

MS. FARROBA: Well, as the network is currently designed is it feasible to offer all of these different bit rates?

MR. LUBE: Not in --

MS. FARROBA: Are you saying not right now?

MR. LUBE: Oh, I'm sorry.

MS. FARROBA: Go ahead.

MR. LUBE: Not in unlimited quantities. You all

may be aware of SBC -- the SBC ILECs just released a letter to the carriers earlier this month announcing a CBR broad band service over the project pronto platform.

The band width of the service we're offering and the amount of that service that we can offer on an RT by RT specific basis is limited, again because of these band width considerations and cost considerations that I've been talking about.

MR. FARROBA: Right. But I guess what we're trying to get to is technically what are these limitations and what do you have to do?

You talked about having to add additional capacity such as with the OCD, etcetera. What is it that's determining the feasibility right now of adding that new CBR offering? I mean what is it that you have in place that allows you to make that feasible? Did you have to upgrade something? Is there enough capacity now? What are the different components?

MR. LUBE: Okay. Well, the basic components of the project pronto network that we're talking about right now are the NGDLC remote terminal, since it has an Alcatel light span 2000, just as a for instance. Well, that actually is the predominant vehicle we're using right now. The OCD in the central office and the fiber connections that are between that remote terminal and the OCD.

The capacity that is installed in our network right now -- of course, it was originally put out there on a UBR basis because the primary objective of pronto was to reach the mass market with Internet access. But capacity-wise with what's deployed in the network today, we are able to accommodate some degree of CBR service. But like I said, it's a 96 kilobit service which allows voice to be carried with DSL by the CLEC if they want to do that.

It is not unlimited in terms of the number of end-users in a particular RT. In other words, in a typical RT we have 672 end-users that we intend to serve DSL. I'm talking about one of the light span type RTs. All of them cannot have CBR and all of them cannot have unlimited amounts of band width on CBR because the pipes or the fiber paths back to the CO will become exhausted.

If you do some things to the network to increase the amount of that band width you can take back from the RT to the CO then you're adding to the OCD costs. You have to add more OCD ports, which may trigger you to a second or perhaps third OCD box or switch in the central office. Those are the kinds of impacts I'm talking about.

MR. STANSHINE: If I understood you correctly then, it's a matter -- you don't need new features. It's a matter of bonding either additional interface cards or higher speed interface cards on the OCD, the same thing at

the RT or in the loop electronics. Possibly more -- but it's more stuff rather than new kinds of stuff?

MR. LUBE: Well, let me clarify one aspect of your statement.

MR. STANSHINE: Yes.

MR. LUBE: In our architecture we are using the -- the optical card we're using at the OCD and the optical card we're using at the NGDLC remote terminal is the highest that's available. It's OC3C or OC3. It's the highest band width available to us today.

MR. STANSHINE: I thought there were OC12 cards available on the light span.

MR. LUBE: There is a light span 2012 that I'm sure Dr. Ransom can describe more eloquently than I can, but basically the DSL capable channel banks that are within the light span 2012 are still fed at the maximum OC3 rate.

MR. RANSOM: That's with any detail that you want.

MR. STANSHINE: But that in a nutshell is correct?

MR. RANSOM: That is correct.

MR. STANSHINE: Okay.

A PARTICIPANT: -- per channel?

MR. RANSOM: Per channel bank? Because there's channel banks in --

MS. FARROBA: I'm sorry. Just a second. This is Kathy Farroba, for the record. I think we need to just make

sure we identify ourselves and then also would you speak up a little bit.

MR. REILLY: Dave Reilly with Rhythms. Just to clarify on that. The 0C3 per channel bank, is that on a per channel bank basis, meaning there's multiple channel banks in the light span or is that per light span?

MR. RANSOM: The OC3 -- and this is Neil Ransom from Alcatel -- in the light span system and whether it's light span 2000 or 2012, there is an OC3 which is shared across multiple channel banks and, in fact, can be shared across multiple light span systems.

So the 0C3 capacity is shared across the entire light span, be it multiple channel banks, and can be shared across multiple light span systems.

MR. McNAMARA: Let me add one thing to that. Actually, there is a way to handle a little bit of additional capacity. They can, indeed, be shared across multiple channel banks but it actually is available on one single channel bank assembly. You an actually isolate an 0C3 down to as few as about 200 lines, but that requires additional transport capacity, a lot of additional money to beef up this capability.

The key thing to remember is that the services that the ILECs are offering today is basically UBR. We've found we can very effectively support at least 2000

subscribers on a single DS3, which is the core of our network. We rarely exceed more than about 50 percent capacity on a single DS3.

If you compare that to what you can do with CBR -- let's say we're trying to give someone 500 kilobit CBR, in a single DS3 you could put 90 customers in there and it's completely filled as opposed to 2000.

MR. KIEDERER: Charlie Kiederer with Verizon. One point I want to make and I think it brings together maybe a lot of what we've heard today.

You know, we as incumbent local exchange carriers, have probably built the most efficient voice network in the world. Now what we're trying to do is to force-fit data onto it.

Whereas, if you had your druthers or had the opportunity for a desert start or had the proper economic incentives you might do it a different way. We would not necessarily use NGDLC and we wouldn't be talking about whether you use a light span 2000 or a light span 2012 because there would be other ways of doing this.

So I think we need to keep that fact in mind of where we've been, where we're going and what we're trying to do with this. You know, we're trying to force-feed advance services onto what started out to be a platform that was meant to efficiently serve voice traffic. So we need to

keep that in mind.

With regard to the CBR, the issue did come up that to the degree you have many, many, many CBR customers served off of that RT, depending on the pipe that you have going back from the RT to the CO, there is a possibility that you certainly can exhaust that pipe. Then you're faced with putting in more broad band transport capability from the RT back to the CO.

I also don't want to minimize the fact that whatever you do at the RT and whatever services you decide to offer, whether it's one, three or six, all of them have implications in the EMS' and in the back room operation support systems that have to drive all of those service provision inventories.

MS. ROSENWORCEL: You know, building off of that question. If we could just look towards number seven, which is, what options are available to the ILECs if the capacity of the shared transmission facility nears exhaustion? What are the options available if interoffice transport, just for comparison, nears exhaustion?

MR. LUBE: I think it's very perceptive to jump to number seven because it fits in with the description of the changes that I was describing that we would need to accommodate large amounts or larger amounts of CBR and that type of thing.

Let me preface really quickly though, I mentioned a minute ago during this same discussion the price-competitive nature of the overall broad band market even with respect to the other technologies like cable modem out there.

The type of thing that we're talking about in ILEC maybe having to do to upgrade its network with more capacity is the very time of thing that has to be looked at very seriously because of the economic impact of that additional cost. Is it going to price DSL out of the broad band market? That's a very critical concern to all of us that are trying to sell it.

But, anyway, to number seven specifically, there were basically three different scenarios and there may be variations of these three, but I think there's probably three major in my mind scenarios that we would use in the project pronto architecture.

Before diving into those, just to add something to what Charlie said, he mentioned or made the comment about when trying to use this network we may have to add more transport capacity back to the CO.

I cannot overemphasize the fact that it goes beyond just the transport back to the CO. What's happening inside of the CO is also a very big cost factor here. As I've said several times already, we use this OCD in the

central office and the more OC3 connections or paths that we bring in from the RTs and have to terminate on OCDs we need more OCD port capacity.

OCDs are port capacity limited. So we may have to buy a second OCD full of cards with more port capacity. So these are major, big-ticket cost items.

Okay. Now to get into the three -- and, by the way, I think this will answer the question that was asked by the Rhythms engineer just a little bit ago as to whether the OC3 is per RT or per channel bank?

To add to what Dr. Ransom replied on that, the way that we're deploying the 2000 -- the light span 2000 in our network -- there's typically going to be three DSL channel banks in an RT. Within that RT those three DSL channel banks are chained together such that we use a single OC3 coming back into the CO for that entire RT.

Again, that RT we're looking at in that configuration is probably 672 end-user -- not probably -- we're looking at 672 end-user capacity.

MR. STANSHINE: Per three -- is that 224 per channel back or is it --

MR. LUBE: It's 224 per channel bank, yes, sir.

A PARTICIPANT: -- or looking forward?

MR. LUBE: I can't speak for the vendors on that. I'm sorry. But, anyway, to continue on, what we would have

to do as one of the options of dealing with the question asked in number seven is to unchain the three channel -- the three DSL-capable channel banks within the RT. What that would do, we would physically be bringing three separate OC3Cs back to the central office.

Now just to give you some metrics on my OCD capacity comments, consider the fact that we may have 20 or let's say up to 20 -- not in every wire center, but 20 RTs within a central office, a wire center area. If I triple the amount of OC3s that I bring back into the central office, I triple the amount of ports that I need on the OCD which specifically is what triggers me into a second OCD switch or a third OCD switch in some instances.

So, anyway, that would be my first option, to unchain the channel banks. That would require more fiber, more OCD.

In addition -- and I may be incorrect about this, but I believe that would even involve taking some of the channel banks out of service, but I would have to defer to the folks that understand how -- we've not done that so I don't know what exactly that would cause.

The second option is really a variation of the first. It would be to unchain the three DSL channel banks and instead of using three times the amount of fibers to come back to the CO, a technological possibility -- I don't

consider it economically feasible, but a technological possibility is to put something like DWDM on the fiber so that I can carry all three of those OC3s or OC3Cs back on maybe the same fibers.

There are problems inherent with that because DWDM is generally fairly large and uses a lot of power and there's heat dissipation issues. So we regard that as not being a viable alternative in the RT environment. So I'd have to say my second option is really probably no option at all economically to us.

The third option, which is really the worst, would be to add another NGDLC, a whole new RT structure. Obviously, that requires all of the costs of the additional RT, the additional fibers to feed that, and, of course, the common problem of the additional OCD capacity.

MS. FARROBA: Thanks.

Actually, we'd like to hear about some of the other network architectures that are out there, but -- well, I had a question, as well. I'll just throw it out there and then, Jerry, go ahead with yours.

But on the upgrading of the capacity, you said it would require additional OCD ports. I wanted to know if you're upgrading capacity because it's due to converting the constant bit rate instead of the UBR that's out there, why that would take additional OCD ports?

MR. LUBE: Well, I think for the numerical example that my colleague from Bell South, I believe it was, gave a minute ago, you know, if you're looking at CBR at -- I'm just trying to think of an example. Well, I think you said like 500 kilobit CBR and I think you said 90 customers. I'm not sure what --

I think we figured that if you're looking at -- oh, I forget what our calculations were -- I could run through those in a minute or figure those out here in a minute, but what happens is if you have individual users with CBR with band widths in the hundreds of kilobits per second, that literally consumes the available band width on the facility going back to the central office, you know, on the OC3C.

In an OC3C, I think our estimates are that you get about 135 megabits per second of useable DSL band width coming back. I suppose if you had one megabit CBR you could put 135 customers on there and then it's gone.

If you say, well, you know, I could go ahead and unchain my three channel banks, I still have a port capacity for customers of 224 per channel bank. If I only get 139 -- excuse me -- 135 CBR customers on 224 port capacity hardware then I've stranded some of our hardware out there. That's a cost, another cost to me, another cost that affects the price competitiveness of DSL and the bigger broad band

market. There's just a lot of issues like that.

MR. ROSENWORCEL: Copper Mountain.

MR. REISTER: Yes. I feel like -- you asked what determines the feasibility, it's the chips, of course, that are in the equipment and it's the vendor of the carrier's equipment choice.

A couple of points. One is that you can provide a wider array of classes of service today. I mean there are -- boy, there are OC3 SARs that can do quality of service for -- on a variety of classes with queuing for, you know, 10,000 individual ques for $80 or $90 dollars for the chip. Obviously, by the time the vendor goes and integrates it into their equipment and has their profits they charge the customer. But it's certainly feasible today and has been feasible for quite some time.

I think that the issue here though is we keep talking about this quality of service and CBR per subscriber, which is a really crappy -- in my opinion -- crappy way to do it because, obviously constant bit rate is what it sounds like, which is, you are permanently allocating that band width on a per subscriber basis.

So, you know, it's commonly called like a circuit emulation service because you can use it to create the equivalent of a T-1 from Point A to Point Z.

But what would make a lot more sense, is, if you

did the constant bit rate in the ATM Lexicon you called it a virtual path, which in English is like a tunnel that you can put many lanes into. So now either the incumbent carrier or a competitive carrier could say, "I would like 10 megabits out to this particular location" and the only thing that the incumbent carrier would have to architect for is that 10 megabits.

At that point now, how much traffic each individual subscriber going into that tunnel takes up, does not matter a wit to the incumbent carrier architecting their fiber, it's just that 10 megabits and there's a variety of things you could do for the individual subscribers feeding into that.

You could certainly provide real-time services, burstable services. You could just divide the 10 megabits using weighted fare queuing. There's a lot of schemes you could do. But you've set that tunnel so that the outer bound is that 10 megabits and now the CLEC knows exactly what it's paying the ILEC for.

It's the same concept when a carrier is putting equipment in a collocation space and they've got a DS3. There they've got 45. The nice thing is if one carrier was more successful than another in a particular market area they can say, "Hey, I would like to go from 10 megabits to 20 or whatever." Obviously, the carrier that was managing

the facilities would then charge correspondingly based on the 155 megabits that was available.

In terms of question seven, to upgrade it, you could -- I mean the fiber itself, assuming it's single-mode fiber, doesn't really care whether it's OC3 or OC12. What does cost is the interface card that would be on the RT device and the interface card on the OCD. OC12 certainly does cost substantially more than OC3.

Presumably though, if you were running out of capacity on it, it would be because you had so much service and if you had that much service hopefully you would be getting revenues that would correspond to that type of a band width upgrade.

Then, finally, I point out that ATM is not the only way to carry over fiber or maybe I should say SONET. There was the mention of DWDM, which is currently I agree too expensive in this environment. But there's gigabit ethernet and other fiber-based technologies that over the coming years certainly hold the promise of substantially increasing the band width available.

MS. FARROBA: Jerry?

MR. STANSHINE: Just to get a couple of things on the record with Alcatel and AFC. Your CBR is virtual circuit and not -- or virtual VC rather than VP, is that correct?

MR. RANSOM: Well, the current offering we have is a virtual circuit where we're adding also the virtual path, but that's a virtual path going to a single customer.

I think what Copper Mountain was asking for was whether there was a way to share a single CBR virtual path across multiple customers and that's not currently scheduled for this product.

MR. STANSHINE: Okay. NAFC?

MR. SACKMAN: We only do virtual circuits today and we haven't been asked by anybody to do virtual paths.

MR. STANSHINE: Got ya.

And for SBC, if the network has to basically absorb substantial extra cost for CBR service is there anything about the technology that would force you to burden the UBR customers with this or could you really concentrate the cost recovery in your tariffs on CBR customers?

MR. LUBE: Well, first of all, I have to put the disclaimer out that I'm not a pricing spokesperson. I really don't know how we would differentiate the pricing between the UBR customer and the CBR customer.

I do also want to clarify that as deployed, our network does have a limited amount of CBR capacity. I do want to restate that because I don't want there to be a perception that it's not possible to put any CBR over the deployed network today.

If I might also just branch out for just a second into the permanent virtual path, the PVP. I don't recall that you had a question specifically about PVP, but that's another capability that a lot of the carriers have desired in the proceedings, in the state proceedings, that I have been in around the country.

PVP is a particularly onerous issue to us right now for at least two distinct reasons. I think you need to understand this part of the technology to see where we're coming from.

First of all, if you had multiple -- even multiple carriers out there saying, "Gee, I think I'd like a 20 megabit PDP" and another carrier comes along and says, "Gee, I think I'm going to do really well in this service area, so I'd like a 30 megabit."

I mean you get to a capacity management issue of which CLECs get have what sizes and what do you do when the next CLEC comes along and you don't have any more size left or any more capacity left? That's an issue that we see in terms of the band width available in the OC3C that we have today.

But also I mentioned, and I think Dr. Ransom referred to this on behalf of the light span, the current product that we have now -- and please correct me if I misstate this -- but I believe we have a capability of one

PVP per channel bank.

So if there is CLEC No. 1 that would like a PVP and one of my RTs, it literally instantaneously wipes out one third of my customer or end-user capacity for DSL in that RT. I think there may be some other developments in future product releases, but there's limitations as we understand even in those further developments.

MS. FARROBA: Okay.

I think the gentleman from Rhythms had something he wanted to say and then we might want to move on.

MR. REILLY: Yeah. This is just a question concerning the capacity issue. I think it was Bell South that had mentioned they could get 2,000 users on an OC3, but yet there's only 672 customers that could be served out of an RT, a next-generation RT. So the numbers don't add up from a band width capacity issue.

MR. McNAMARA: Well, that's actually for one light span system. You can actually serve 2,000 customers from a light span. But I wasn't specifically even talking about RTs. I was talking about ATM in general.

MR. REILLY: Right, right.

MR. McNAMARA: And, actually, 2,000 customers per DS3 and not OC3.

MR. REILLY: Right. So there's an OC3 and 672 customers that can be served out of one next-generation DLC.

There should be a lot of capacity left to do other types of QOS services, UBR, ABR, VBR --

MR. McNAMARA: I wasn't really referring to light span or any channel bank in general.

MR. REILLY: Right.

MR. McNAMARA: I was just talking about the capacity of UBR traffic on a given circuit type.

MR. REILLY: Right. And that's what I'm saying, if you have an OC3 and 672 customers that are doing UBR there's a lot of capacity left.

MR. McNAMARA: If I could --

MS. FARROBA: Just a second, please. I think the gentleman from Nortel --

MR. EDHOLM: I think -- Phil Edholm from Nortel.

I think it's really important to step back and understand the architecture of the networks in place today are based on -- it's the good statistical nature of data. So data innodes are very bursty, whether they're web browsing or doing e-mail.

As you move up in the network, the natural smoothing effect of gathering up multiple users tends to reduce that burstiness. So at the edge where you have dedicated band width, the burstiness is handled by dedicated band width. As you move farther up in the network, the burstiness is handled by spreading it out across lots of